

Protecting the Tangible and Intangible Heritage of Rani ki Vav: a Unique Subterranean Step Well in Gujarat

PRIYA T.Lakshmi^{1, a}

¹Sector D-7, Flat no. 7177, Vasant Kunj, New Delhi, India

^atlpriya@gmail.com

Abstract The stepwells define the subterranean architecture of Western India. The term stepwell indicates the basic architectural features of a monumental well comprising of a long corridor of steps leading to five or six storeys below the ground to a well. From the 7th to the 19th century, stepwells were an integral part of the Western India. Stepwells are a response to arid regions of Western India particularly in Gujarat and Rajasthan where water is treated as a sacred element which defines the lives, myths and rituals of the people. The stepwells of Gujarat are exceptional in their monumental scale and details. One of the magnificent stepwells is located near Ahmedabad known as Rani ki Vav. The construction of this stepwell began in 1063 A.D and probably it took some ten to twenty years to complete its construction that is upto 1085 to 1090 A.D.

It is constructed of bricks and decorated with stone sculptures. It measures 64m long 20m wide and 27m deep. It has the four essential components which are seen in completely developed stepwells : a staircase leading from the ground level to the underground basin, intercepted at regular intervals with multistoreyed pillared pavilion, a well at the rear end, and a large tank or kund to store the surplus water from the well. This Vav also has bracing structures just above the tank, as an extra precaution against lateral thrust. The side walls of the staircase have niches and the wall surface of the well are adorned with beautiful sculptures.

The stepwell was in use during the 12th and the 13th century, during the reign of Sidharaja. During this period the niches in the stepwell were filled up with marble sculptures. Later in the 13th century huge amounts of sand and silt were deposited in the well due to major floods of the Saraswati river which flows adjacent to this well. Other floods gradually silted up the entire well. Historical records mention that the well was functional and periodically desilted. The well was buried for centuries under the soil.

The Archaeological Survey of India undertook the major task of desilting and restoration of Rani ki Vav which was declared a protected monument of national importance in 1940s. Desilting of the stepwell was commenced in 1960 A.D. Extreme care was taken while resetting of the architectural members and fixing the sculptures in their proper position. The conservation works were aimed at retaining the authenticity and the integrity of the monument during the restoration works. The stone used in the construction of this Vav is sedimentary sand stone varying from fine grain to coarse grained structure. Several test such as wet chemical analysis, X ray analysis, soil analysis etc were undertaken to understand the weathering of the stone. Today Rani ki Vav reveals its original grandeur and stands testimony to the expert craftsmanship and technology of the builders of the 11th century. This paper aims to bring forth the significance of this unique typology of stepwell and the continuing efforts undertaken by Archaeological Survey of India for restoring this historic monument.

Keywords: Protection, stepwell, Rani ki Vav

Introduction

Geographical Location The Rani ki Vav or the Queen's stepwell is located in Western India, in a small town called Patan (Lat.23° 51'N; Long 72° 11'E), about 134 km north west of Ahmedabad. Patan was originally known as Anahilvada or Anahilapura, which was the medieval capital of Gujarat. This

Vav is situated to the north-west of the present town of Patan, near the old fort on the southern bank of Saraswati river. The depth of the rocky bed in this region lies at an average depth of 60m.



Figure 1: View of the Stepwell

Historical Context Patan originally known as Anhilvada was founded in 746 A.D. by Vanaraja the first ruler of Chavada dynasty. This dynasty ruled over Gujarat and Saurashtra upto 13th century. Patan attained its greatest splendour under the Solanki rulers. Bhimadeva I (1022-1064 A.D.) was one of the most powerful rulers of this dynasty and he built many temples and his wife Queen Udaymati constructed the famous Rani ki Vav as a memorial to her husband. The construction of this stepwell began in 1063 A.D and probably it took 10 to 20 years to complete its construction that is upto 1085 to 1090 A.D.

The consecration of the step well was performed by the Queen, and the stepwell was in use during the 12th and the 13th century. During this period the niches in the stepwell were filled up with marble sculptures

The Jaina pontiff Merutunga saw the stepwell in the late 13th century. Later in the 13th century a major flood of the Saraswati river brought down the upper parts of the structures and deposited huge amounts of sand and silt in the pit. Other floods gradually silted up the corridor, but the well was functional and periodically desilted.

In 1300 A.D. when Muslim rule was established in Patan, Hindu and Jain temples were destroyed but during this period the stepwell remained hidden. Between 1805-1811 A.D. the land of stepwell came into the possession of Bahadur Singh barot a court official of Anandaraao Gaekwad of Baroda or Vadodara State, during this period, loose slabs, pillars and lintels etc were removed from the Queen's stepwell to build the Barot Vav.

Travellers in the early 19th century, visited the site and inspected the Torana and the well of the monument. After independence the Archaeological Survey of India declared Rani ki Vav stepwell as a protected monument. Desilting of the stepwell was commenced in 1958 A.D. The Vav was systematically desilted and conserved after declaring it as a monument of national importance. Extreme care was taken while resetting of the architectural members and fixing the sculptures in their proper position.

Concept of Stepwell

From the 7th to the 19th century, stepwells were an integral part of the Western India and they are the best examples of subterranean architecture. The basic function of a stepwell is to store water in the arid regions of western India particularly in Gujarat and Rajasthan. Narrow steps go deep in to the earth upto the well. These steps are intercepted in each storey by pavilions and galleries which provide shade to the community using the well. Scarcity of water during the ten dry months of the year emphasizes the need for storage of water which is treated as a sacred socio-cultural element.

The stepwells of Gujarat are exceptional in their monumental scale and details. These stepwells were important community centers and invested with strong religious meanings. Religious rituals and

bathing transformed an ordinary well into an ideal water structure suitable for household activities. These stepwells served in mitigating the local water scarcity and were active social spaces for the community. They also provided a cool resort for travelers and the local people.

Typology of Stepwells

There are several stepwells in Gujarat which can be broadly classified into five main typologies based on their architectural features:

a. Stepwells with straight stepped corridor and a single entrance: This typology of stepwells is characterized by a single entrance. These stepwells have lateral stairs which reduce the length of the corridor and help in reaching the lower levels more quickly.

b. Stepwells with straight stepped corridor and three entrances: This type of stepwells have three flights of steps arranged clockwise and attached to the stepped corridor.

c. L –shaped Stepwells :This is exclusive to Gujarat and found nowhere else, it has a L shaped plan form and the stepped corridor turns at right angles. This is the earliest structural built stepwells in Gujarat.

d. Stepwells with Circumambulatory passage around them

e. Stepwells with cross shaped ground plans

Stepwells can be chronologically categorized according to the period of construction, the Pre Solanki period (8th to 11th century), the Solanki period (11th to 12th century), the Vaghela period (mid 13th century to 14th century), the Sultanate period (14th century onwards).

These stepwells can also be categorized according to their location and usage for example stepwells located near a temple or housing a temple: these were used for religious purposes. Stepwell within or edge of a village: these were used mainly as a place for gathering and for agricultural purposes. Stepwells located outside the village, on the trade routes: they were used as cool places of retreat for the travelers seeking temporary shelter.

Rani ki Vav which was constructed during the Solanki period , belongs to the category of step wells having straight stepped corridor with single entrance also having lateral stairs. It was used for religious purpose and stands as a memorial to the Royal King.

Architectural Description of Rani ki Vav

The Rani ki Vav is oriented in the east west direction , with the well in the west and the entrance in the east. It is built of bricks and decorated with stone sculptures. It measures 64m long 20m wide and 27m deep. It has four essential components: a staircase leading from the ground level to the underground basin, intercepted at regular intervals with multistoreyed pillared pavilion, a draw well at the rear end, and a large tank to store the surplus water from the well. Additionally this Vav also has bracing structures just above the tank.



Figure 2: The Wall of the well adorned with sculptures

Four pavilions which mark the various levels of the stepwell have multiple storeys, two, four, six and seven respectively, the roof of the top storey of each pavilion reaches up to ground level. There

are seven terraces on the corridor's walls. The side walls of the corridors with niches and the wall of the well are decorated with beautiful sculptures.

The shaft of the well is divided into seven horizontal levels. The Vav is decorated with most exclusive sculptures. The pillars of the corridors carved with vase-foliage motif add to the beauty of the Vav. More than 800 large sculptures were planned to decorate the seven terraces on the walls. The sculptures in this monument can be categorized according to the three aspects they highlight; the images of Visnu which attribute to the Vaisnava character of the Vav, the images of Parvati's penance which emphasizes the memorial character of this stepwell and "the images of conjunction".

Desilting and Restoration of the Stepwell

The following structural works were undertaken by the Archaeological Survey of India:

- a. construction of the fallen retaining wall,
- b. resetting of the out of plumb parts of the side walls and
- c. other conservation measures.

In 1963, the debris accumulated in the passage leading to the shaft of the well was removed, exposing a part of the side walls. The dislodged stones were reset upto a height of 11m. In 1969, loose sculptures and the stones lying inside the well were removed after in situ documentation. The dilapidated side walls were set right and their sculptures fixed in position. In 1973, the missing ashlar masonry was rebuilt with stone matching the original stone used in the Vav. Due to flooding of the well by rain water, conservation works had to be discontinued. Again conservation works were resumed in 1977. The desilting of the well and resetting of side walls which were out of plumb was commenced. The work of exposing hidden structures was continued. The dressing and carving of the stone for the missing portions was undertaken. The missing portion of the northern side wall and terrace platform were restored. The damaged and worn out stone flooring of the 1st and 2nd pavilions was removed and replaced with fresh Dhrangadhra stone matching the original property. The cracks that developed due to earthquake in the front walls and open joints were grouted.

Outstanding Universal Value

The Rani ki Vav step well stands testimony to the phase of architectural construction of the late 11th century when the builders had mastered the art of construction of step wells. Each architectural component of this step well expresses the complete potentialities of its form which has evolved over centuries. The distinct uniqueness of this step well, lies in its monumental scale, profusion of sculptures, quality of workmanship and details. Rani ki Vav represents a sculptural manifestation of a subterranean architectural form dedicated for a simple function of drawing water. The distinguishing features of this stepwell lies in the treatment of the seven levels, its pavilions, the terraces, its principal and supplementary staircases and its large tank. This Vav represents a unique socio cultural process and intermixing of functional aspects along with social /religious and cultural affiliations. This Stepwell is one of the largest step wells in Gujarat and is adorned with over five hundred sculptures, which surpasses all other step wells in the region. The studendous sculptures adorning this Vav portrays the high aesthetic sense and the creativity of the Solanki rulers, who ruled Gujarat in the 11th century.

Traditional knowledge System: Construction of Stepwells The builders of the stepwell employed their most skilled artisans in the erection of this monument. The practice of digging wells in memory of the dead king was a widely prevalent tradition in the ancient times described in the inscriptions. The construction of stepwells follows a unique ingenious method. A well upto the depth of a man's height is dug. Then a circular wooden platform made of non decaying Semal wood, is lowered into the well. A brick wall is erected around the well upwards from the bottom. While the brick wall hardens, further digging is done under the wooden platform, and when the digging is upto a depth of a man, the wooden platform is lowered again. In this method of construction, the veneer becomes thicker and the well becomes narrower as the depth increases. This is done till the water is

reached. To counteract the forces on the three quarters of the circumference of the stepwell, buttresses were built on both sides of the staircases behind the veneer.

The Stepwell as a strong Socio-Cultural element The sculptures demonstrate the importance of this Vav in the social and cultural life of the people

The Vav is associated with the tradition of the Vaisnava cult and the worship of Mother Goddess. According to the belief Visnu as Narayana is associated in Hindu mythology with Cosmic waters, wells, tanks and stepwells. The stepwell is dedicated to this God. This God reclining on *Sesa*, the mythical serpent, was installed in the well to replicate the myth associated with the beginning of Creation. The incarnations of Visnu have been depicted in this Vav, Visnu as Narayana is seen in the form of sculptures in the IIInd, IIIrd, IVth levels in the wall of the well as well as in the walls of the corridors.

There are 15 images of Devis, who are regarded as the members of the twelve Gauris, who are associated with the cult associated with women. These images depict the myths associated with Parvati as the Sati and emphasize the memorial character of the monument. As this stepwell is constructed by the Queen for her departed husband the images of the goddess performing austerities could be said to be expressing the queen's own yearning to be reunited with her husband in the future life. This Vav represents the values and ideologies of the Hindu women in the medieval ages. The serpent maidens (nagakanya) and the apsaras according to tradition were conceived as the dwellers of the water. Various sculptures of serpent maidens, apsaras, yoginis are seen in this Vav.

Causes of Deterioration

The primary causes of deterioration of this stepwell are:

- a. The flooding and piling up of debris in the well
- b. Collapse of structures
- c. The silting process which has caused precipitations on the original stone structures
- d. Weathering of stone due to the underground microclimate

Scientific Studies undertaken at the Vav

The Science branch of Archeological Survey of India in Vadodara and Dehradun have undertaken scientific studies to understand the exact nature and composition of the building materials used in the construction of this stepwell.

The Building Material The stone used in construction of this Vav is creamy color sedimentary sand stone varying from fine grain to coarse grained structure. The medium and coarse grain stones have been used in construction of pillars, niches and slabs whereas fine grain stones have been used for the sculptures. Wooden dowels have been used for joining the stones. Wet chemical analysis, and X-ray analysis was conducted to understand the nature, composition, geological weathering of the stone and the nature of accretions found in this structure.

Analysis of the surrounding soil and water samples have also been carried out for relevant parameters and a correlation between all the scientific results has been established. The analysis of Stone, oolithic accretions and SEM studies of stone were carried out and a paper was published in the 8th International Congress on Deterioration and Conservation of Stone held in Berlin in October, 1996.

Chemical Treatment

In the year 2001-2, micro vegetation growth was removed using suitable mixture of chemicals and bio deterioration arrested by applying fungicide. Further care was taken to prevent the future re-growth of micro vegetation, by applying preservative coat PMMA in toluene. The sculptures were consolidated with ethyl silicate.

The conservation problem of localized erosion was eradicated with the filling up of eroded area with a mixture of similar stone powder and ethyl silicate solution. Later the area was saturated with

ethyl silicate solution. Further fungicide and preservative coats were applied on the whole area of sculptures.

The phenomenon of localized erosion of the sculptures with color change is generally due to the presence of iron rich bands or veins. These studies also indicate that the discontinuous hard crust cannot be regarded as a protective layer and it is desirable to remove it with care.

The mature sand stone have high $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratios with the absence of Aluminosilicates. The XRF results reflect the geo chemistry of sand stones in the Vav and it indicates that the stone are two types: those with the high SiO_2 content and with high ratio of $\text{SiO}_2/\text{Al}_2\text{O}_3$ called quartz Arenites and others with less SiO_2 and with $\text{Na}_2\text{O}/\text{K}_2\text{O}$ which are called Feldspathic gray wackes.

The source of sand stone is possibly near by Dhrangadhra Sand stone formation of Mesozoic age. The sand stones of vav are influenced by carbonate and ferrogenous fluids. The range of chemical composition of the common sand stone types and the average sand stone has been summarized it is suggested that the quartz amites are nearly pure SiO_2 , the Al_2O_3 coming from clay and CaO from Calcite cement. The Lithic Arenites show much more Al_2O_3 , and the other major elements most deriving from Argillaceous rock fragments, Gray Wackes have lower SiO_2 than most sand stones, more Al_2O_3 and, Na_2O contents predictable from the high proportion of Feldspar.

Petrography

Petrography was done on representative samples of architectural members from vav: walls, pillars & capital and sculptures. The sand stone used for walls is coarse to medium grain clasts of quartz cemented by silicious cement. The grains are angular to sub-rounded, elongated and unsorted. Flakes of muscovite are occasionally observed. Bedded sand stone is used occasionally.

The sand stone used is mostly bedded showing intercalations of fine and medium to coarse grains of quartz. The cementing material is siliceous, however it further influenced by secondary leaching of iron resulted in brownish reddish patches. Petrography shows iron has partially influenced the original cement. Sand stone used in sculptures is largely fine grain, equigranular, angular to sub rounded quartz grains, with siliceous cementing material. Secondary leaching has partially influenced the original cement of the sand stone used in sculptures. However few sculptures are completely influenced by secondary iron leaching giving reddish brown tinge to the sculptures. The petrography, studies shows high polarizing color of quartz and ferrogenous cement. The rock of sculptures shows vertical plane bedding planes which have been used as path ways for ferrogenous fluids and have further acted as parting planes enhancing onion like exfoliation.

Soil and Water Analysis

The horticulture branch of ASI carried out soil analysis of Rani ki Vav. This analysis reveals that the soil pH value is 9.6. The calcareous nature of the soil and the high ph value under which the vav was silted up might have contributed to the precipitation of calcium salts on the stone surface. These salts after excavation converted to hard calcium carbonate ie oolithic layer on the stone surface.

Table 1: Water Analysis

Sl. No.	Parameters	Results	
		Sample of Rani ki vav	Sample of Bore well water
1	pH	7.3	709
2	Conductivity	0.63 mho/cm	303 mho/cm
3	TDS	447 mg/L	2576 mg/L
4	Sulphates	132 mg/L	150 mg/L
5	Total Hardness as mg/L of CaCO_3	196 mg/L	630 mg/L
6	Hardness due to Calcium	109 mg/L	220 mg/L

The analysis of soil and water samples have also been carried out by M.S. University, Vadodara and results obtained are as follows. The soil analysis shows that the water has higher pH value and alkaline in nature. Similarly results of soil analysis also shows high pH indicating the presence of alkaline salts. The higher value of total hardness and the hardness due to calcium indicate that this might have contributed to the accretionary deposits on stone.

Table 2: Soil Analysis

Sl. No.	Parameter	Results
1	pH	9.6
2	Texture	Silty loam
3	Moisture content	20%
4	Calcium	196 ppm
5	Magnesium	169 ppm

Management of the Site

The Current Management The ownership of Rani ki Vav lies with the Archaeological Survey of India. This is declared as centrally protected monument and the protected area of the monument is 6171.45 Sq.m. It is a protected under the Ancient Monument Archaeological Sites and Remains Act, 1958 (AMASR Act). The site is managed by the Conservation Assistant of the Patan sub circle at the local level, the Superintending Archaeologist of the Vadodara circle at the regional level, the Director General, Archeological Survey of India at the national level.

The following aspects of the management of the site have to be considered:

Protection and Maintenance of this Vav : Protection and Management of this unique cultural resource is essential. It is important to have a detailed documentation of this Vav, using the technology of laser scanning along with detailed condition assessment. A conservation plan needs to be prepared which shall safeguard the authenticity and the integrity of this monument. This conservation plan should prepare a plan of action prioritizing the areas of intervention. A periodic maintenance program for the stepwell has to be outlined. Currently a day to day maintenance is being undertaken by the staff at the site.

Visitor management plan: Very few tourists visit the site. Parking area for the vehicles, and toilets have been provided on the site. There is a need to provide an interpretation centre and develop a circulation pattern for the visitors. Adequate visitor amenities and proper signage have to be put in place.

Security Management: Trained and efficient staff have to be provided on site to ensure the safety of the visitors, occasionally accidents have been reported by the locals, due to improper fencing of the well.

Disaster management : A disaster management plan which addresses the various natural hazards such as earthquake and floods should be prepared to safeguard this fragile heritage resource.

Information Management: The entire information pertaining to this Vav in the form of documentation, photo documentation, reports, published and unpublished material, archival material must be made available to all the concerned people. Currently information is with the Vadodara circle of ASI and also at the local office. All the information needs to be collated put in a systematic manner.

The management plan must also address the legal and administrative frameworks for the management of the site and its buffer has to be . Coordination between the various agencies acting on the site and its buffer is essential for the protection of this site.

The Task Ahead

Currently Archaeological Survey of India (ASI) is in the process of preparation of the nomination dossier for inscription of this marvelous stepwell in the World Heritage List of UNESCO. Efforts are

being made to protect the site , by addressing the above mentioned aspects of management of the site. A management plan is being prepared which will safeguard the significance of this stepwell, and preserve this unique cultural resource for the future generations.

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